AFPTEF

Air Force Packaging Technology And Engineering Facility

2001-2008 Annual Report

Air Force
Global Logistics
Support Center
403rd SCMS/GUEB


At AFPTEF, one vision drives everything we do: Building a world-class packaging engineering center of excellence by providing cost-effective, timely and flexible packaging products and services into the 21st century.

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DEPARTMENT OF THE AIR FORCE
Air Force Global Logistics Support Center (GLSC)
Wright-Patterson AFB OH 45433-5540

April 2009

Air Force Packaging Technology and Engineering Facility
2001-2008 Annual Report

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NOTES FROM THE CHIEF

The Air Force Packaging Technology and Engineering Facility is tremendously proud to again publish an annual report to highlight the accomplishments of the facility in their support of the Warfighter.

As you may know we were scheduled to close our doors forever in January of 2001 due to reduction in force efforts. After an in-depth review of our mission and what the loss of our capabilities might do to our customers, the decision was made to keep the doors open and rebuild. So in January of 2001 instead of saying good bye, we had to roll up our sleeves and come up with a plan to rebuild. Many of the tasks that were accomplished made the organization leaner, more organized, and more productive. We shaped ourselves to operate as much like a small business as possible to make ourselves marketable to our potential customers. We have been successful in completing projects more economically, and quicker than ever before.

So here we are, eight years later and going strong. I thought it was time to send out an annual report to brag about what we've been able to accomplish in the last eight years as well as to offer our services in solving your packaging and handling issues. So please take a few minutes or longer and review this report and see how we were able to support our troops during some of the most trying times.

Notice that this report covers the years from 2001 to 2008; we felt it was more practical to publish one large report to cover the down time instead of eight individual reports. In 2010, we will go back to our standard format of a yearly annual report as we publish our accomplishments for 2009.

We looked forward to 2008 as we become part of the new AF Global Logistics Support Center (AFGLSC). We are part of the 591st Supply Chain Management Group (Strategy and Integration), under the 403rd Supply Chain Management Squadron (Engineering and Technology). We also saw this as an opportunity to team with the packaging specialists and item managers located at the Air Logistics Centers, now that we are under one chain of command, to better support our customers in a more direct manner.

We will continue to provide the AF top notch engineering, testing, fabrication, and consultation support as we strive to become the AF's premier packaging engineering organization. Our goal is to ensure the dynamic and technical progress in packaging concepts, promote continuous process improvements, and reduce our customer's life cycle costs.

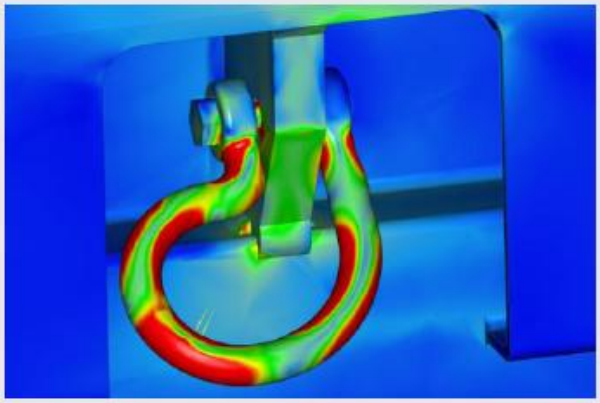
If you need our assistance please contact us at 937-257-3362. We look forward to supporting you in 2009 and beyond.

Robbin L. Miller

The mission of the Air Force Packaging Technology and Engineering Facility is to satisfy our customers' Packaging, Handling, Transportation and Logistic (PHST) needs in times of peace and war. Assures' dynamic technical and engineering progress in container design and packaging concepts. Provides' customer support to Air Force and other federal agencies which includes but is not limited to the identification of requirements, contract support, program reviews, container design, fabrication, testing and evaluation, and the delivery of container procurement data packages and production drawings. Serves as the Air Force representative in DoD and industry standardization groups on packaging engineering issues. Provides' engineering test and analysis for certification of hazardous material containers. Performs lead service test and evaluation for cushioning materials.

SERVICES

DESIGN



AFPTEF has the lead service responsibility for new designs as well as redesigns of specialized, long-life, shipping and storage containers. We have a complete in-house development capability from design, to fabrication, to performing environmental and dynamic tests qualifying the containers for world-wide transportation and storage. AFPTEF engineers use a parametric based, 3-D, solids modeling software for designing, finite element analysis for performing structural and dynamic analysis on components and full container designs, and creation of numeric code for manufacturing. The design process starts out by determining the container requirements. We evaluate the item being packaged for it's fragility, environmental protection, and interface requirements, just to name a few. Then we determine what the handling, transportation, and storage requirements are. We ensure our container design works with support equipment and if we can incorporate features into the design to eliminate the need for special support equipment, we do so. The design/development process yields a prototype container, a production level drawing package, a project report, and a draft special packaging instructions.

FABRICATION

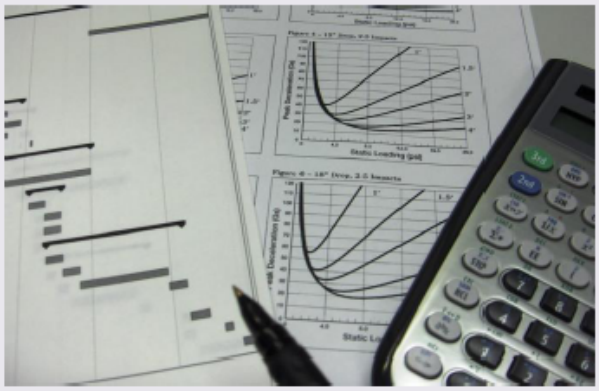
AFPTEF has extensive in-house facilities for prototyping and light production. CAM data is taken directly from the design system and imported into the CNC milling machines for specialized parts and extrusions. The majority of welding is done using TIG welders. The in-house facility is run and operated by a skilled and experienced staff of model makers. Shop capabilities include but are not limited to prototyping aluminum, steel, or wood containers, item restraint systems, cushioning systems for shock mitigation and simulated items for testing. AFPTEF shop facilities are also capable of small production runs to meet mission deployment requirements. In addition, we are skilled in the refurbishment of fielded containers. We fully inspect each container and create a repair process to ensure each container meets original mission requirements. We repair all structural and welding damage, replace all missing and damaged hardware, parts, and assemblies, and then clean and re-stencil the container before returning it to the field.

SERVICES

TESTING

AFPTEF testing capabilities include most of the container and packaging material tests of MIL-STD-648 (Specialized Shipping Containers), ASTM D4169 (Shipping Containers), MIL-STD-810 (Environmental Test Methods), ASTM D3575 (Flexible Cellular Materials), ASTM D4919 (Hazardous Materials Packagings), and 49 CFR 178 (Subpart M). We have the ability to perform package and container design testing either instrumented or not to include rotational drops, pendulum impact, shipboard shock, freefall drop, repetitive shock, random and resonance dwell vibration, pressure, superimposed load, hoisting fitting and tiedown attachment, and forklift. Our large environmental chambers give us the added capability of conditioning even extremely large containers to worldwide temperature and humidity extremes prior to, or during testing. In addition, we are able to perform the environmental hazard test of ASTM D4169, and the blowing rain test of MIL-STD-810. Our Lead Service cushioning materials testing capabilities include dynamic compression, combustibility, creep, compressive set, friability, cold temperature stability, water absorption, and hydrolytic stability. We also perform verification and approval of dynamic compression testers at other locations using an AFPTEF-developed test cushion that provides repeatable dynamic drop data over a large platen weight range, over a long period of time. For DOD shippers of hazardous materials, AFPTEF can perform Performance Oriented Packaging (POP) testing of UN Specification Packagings in accordance with 49 CFR Subpart M (Non-bulk Packagings and Packages). These tests include the drop, stack, leakproofness, stacking, and vibration tests, and the Cobb method of determining the water resistance of the outer surface of fiberboard boxes. We can also provide assistance with interpreting the requirements of Subparts L (Non-Bulk POP Standards) and M, and AFMAN 24-204. Our wide range of testing and consulting capabilities is available to any DOD organization. We can also support contractors for prototype and First Article testing for government contracts. We continually perform research and development testing of new packaging materials and containers to reduce life cycle costs, improve usability and increase the safe transportation of any DOD asset.

CONSULTATION



AFPTEF specializes not only in container design and development but also in container/packaging evaluation and analysis. AFPTEF can evaluate commercial off the shelf containers as well as contractor developed containers. Methods ranging from testing to finite element analysis are employed to measure whether the package/container meets the requirements. We also provide engineering support for container/packaging acquisition. We can develop requirements, prepare the specification and/or statement of work, provide technical support during technical interchange meetings, and perform the first article inspection and test. We can provide assistance in the evaluation or preparation of drawing packages, special packaging instructions (SPI), technical orders (TO), and life cycle cost analysis.

Containers

- Main Landing Gear (MLG)
- Nose Landing Gear
- MLG Axle Beam Assembly
- MLG Post
- Nose Radome
- Fan Thrust Reverser
- Heads-Up Display Unit

Family of New C-17 Containers - 2004

The C-17 Sustainment group (564 ACSS/GFL) located at Robins AFB requested the Air Force Packaging Technology and Engineering Facility (AFPTEF) develop a family of long-life reusable containers that would eliminate the shipping and storage risks for some of the C-17 assets. New designs were developed for the main landing gear (MLG), nose landing gear (NLG), MLG axle beam assemblies, MLG posts, nose radome, fan thrust reversers, and heads-up display unit. Containers were also developed for the brake assembly and OBIGGS winch, but design changes in the assets negated the need for new containers. The goal of the project was not only to eliminate asset damage during the shipping and storage cycle but also to improve handling capabilities. The containers being used at the time (wood and fiberboard boxes) do not have environmental controls and are not sealed by the nature of their construction. These two factors allow the containers to "breathe" with continuously changing environmental conditions. There is no means to control breathing or remove the excess moisture that results, which causes a corrosion problem on C-17 assets. The current packaging degrades readily during use and cannot be stored outside. In addition, damage was reported on some items as a result of inadequate shock protection. All designs are sealed, welded aluminum, and are controlled breathing, re-usable containers developed using many of our standard container features. The containers consist of low profile bases and completely removable covers equipped with many special features. Guide posts keep the cover from swinging into the asset during cover removal and replacement. The base is a one piece skid/double-walled base extrusion with 4-way forklift openings, humidity indicator, pressure equalizing valve, internal document holder and desiccant port for easy replacement of desiccant (controls dehumidification). A silicone rubber gasket and quick release cam-over-center latches create a water/air-tight seal at the base-cover interface. Internal shock mitigation systems vary dependent on asset protection requirements. Many of the container designs are stackable. **In 2004, Air Force cost avoidance over the 20 year life cycle of the containers was predicted to be 1 million.**

DESIGN ENGINEERING PROJECTS

MLG Assembly in Container Base with Part Boxes in Place

C-17 Main Landing Gear Assembly Container - 2004

The structure for the MLG container base is a new design that is composed of an I-beam skid structure with a modified version of our standard base extrusion welded to it. This provides the added structure necessary to support the MLG during impacts and also maintains the usability and functionality of standard base designs. An aluminum mounting system is integrated into the base skid that secures the MLG to the container base. The MLG is attached to the mounting system with three large high density polyethylene (HDPE) lined aluminum clamps with quick release handles that make loading and unloading easy and safe. In addition, there is a vertical frame that supports the MLG post; this also includes a fourth aluminum clamp that has a quick release handle and is HDPE lined. For the loose parts there are two boxes with closeable latching covers. One box is removable and the other is integrated into the base.

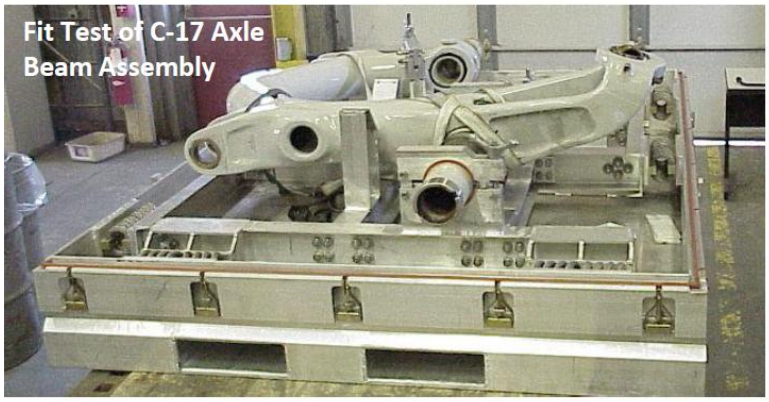
C-17 Nose Landing Gear Container - 2005

The NLG container has an aluminum frame system which is integrated into the container base that rigidly mounts the NLG to the container using three HDPE lined clamps. Two of these clamps are aft while the other is on the forward end of the container. There are also two nylon straps used to prevent the landing gear tires from rotating. In addition to the landing gear, there are also two polyethylene foam lined parts boxes in the container that accommodate the installation kit that ships with the landing gear. These compartments are located on the aft end of the container and are made of welded aluminum.

Nose Landing Gear Fit Check

Who AFPTEF Supports

DESIGN ENGINEERING PROJECTS

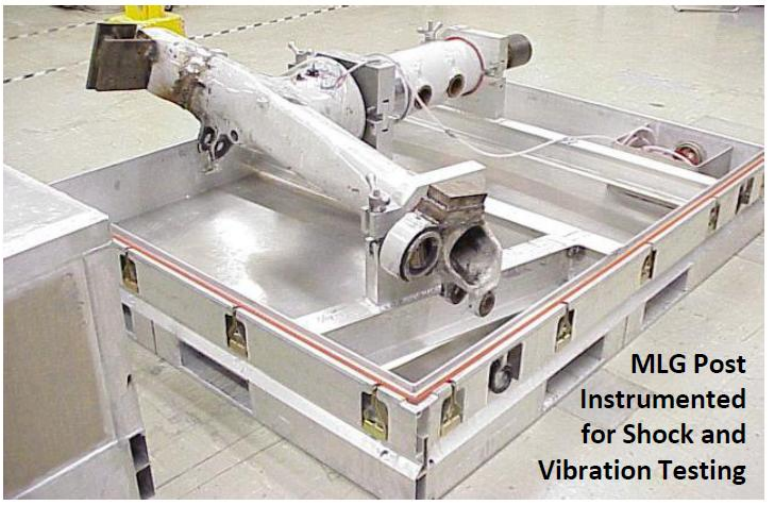

Fit Test of C-17 Axle Beam Assembly

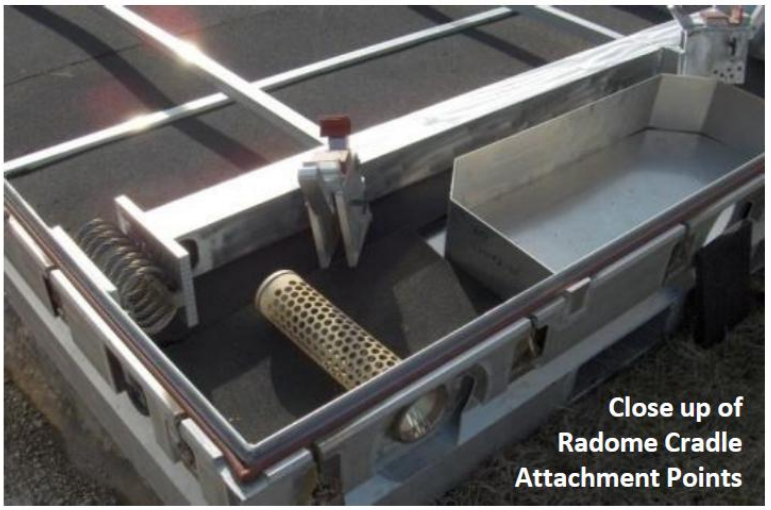
C-17 Main Landing Gear Axle Beam Assembly Container - 2004

The C-17 main landing gear (MLG) axle beam used to be stored in a wood container. The new design is highlighted by an aluminum cradle system which is suspended in the base with wire rope shock isolators. These isolators securely mount the axle beam cradle to the container base. The axle beam is attached to the cradle system with three large rubber-lined aluminum clamps with quick release handles that make loading and unloading very efficient. This container is capable of housing both the left and right configuration of the axle beam.

C-17 Main Landing Gear Post Assembly Container - 2004

The C-17 main landing gear (MLG) post was previously stored in a wood container. There was no damage reported as a result of inadequate shock protection, indicating that the cradle system was adequate. The CNU-677/E container incorporates an aluminum cradle system into the base design that rigidly mounts the post to the container base. The post is attached to the cradle system with three large silicone-lined aluminum clamps with quick release handles that make loading and unloading quick and easy. The cradle can be adjusted to hold both the left and right assemblies of the MLG post.


MLG Post Instrumented for Shock and Vibration Testing


Close up of Radome Cradle Attachment Points

C-17 Nose Radome Container - 2004

The C-17 Nose Radome was usually transported and stored in either a wood box or a fiberglass shell. Neither of these options adequately protected the asset, nor were they stackable or user friendly. The new aluminum container has an aluminum cradle system is integrated into the base suspended on four stainless steel helical isolators that provide shock and vibration protection to 50 G's. The radome is attached to the cradle system on the aft end by rotating two clamping mechanisms onto the radome frame and then tightly securing them with quick release pins. The forward end is then placed by letting both radome hooks rest on high density polyethylene (HDPE) lined aluminum blocks. These hooks are also secured with quick release pins. These radome attachment points are the same points used to attach the radome to the aircraft. The cradle/frame system allows for easy loading and unloading of the radome. The inside walls of the container were lined with a one inch thick layer of polyethylene foam to dampen the ringing effects of the aluminum, amplified by the bell shape of the radome.

C-17 Fan Thrust Reverser Container - 2004

The CNU-688/E container provides an aluminum cradle/frame system which is integrated into the container base and suspended on fourteen stainless steel helical isolators These isolators provide shock and vibration protection to 50 G's. The FTR is attached to the cradle/frame system at the top by placing special quick pins through a u-shaped block and at the bottom with four adjustable turnbuckles. These FTR attachment points are the same points with which the FTR is attached to the aircraft. The cradle/frame system is adjustable to hold either the left or right FTR.

The cradle/frame system allows easy loading and unloading with the use of the field sling. In addition to the FTR, there are additional parts such as hoses and clamps that also must be shipped in the container. This compartment is located between the isolator supports of the cradle/frame system on the forward end of the container. The compartment is made of aluminum channels lined with polyethylene foam and have hinged covers to keep the parts organized and secure during transport. There are no detachable parts on the container other than the cover, which eliminates FOD risks. Certain information has to be verified on each FTR prior to shipment. To avoid removing the cover to obtain this information a series of special viewing ports were installed in the container side walls at strategic locations to obtain the desired information.

FTR mounted on container cradle

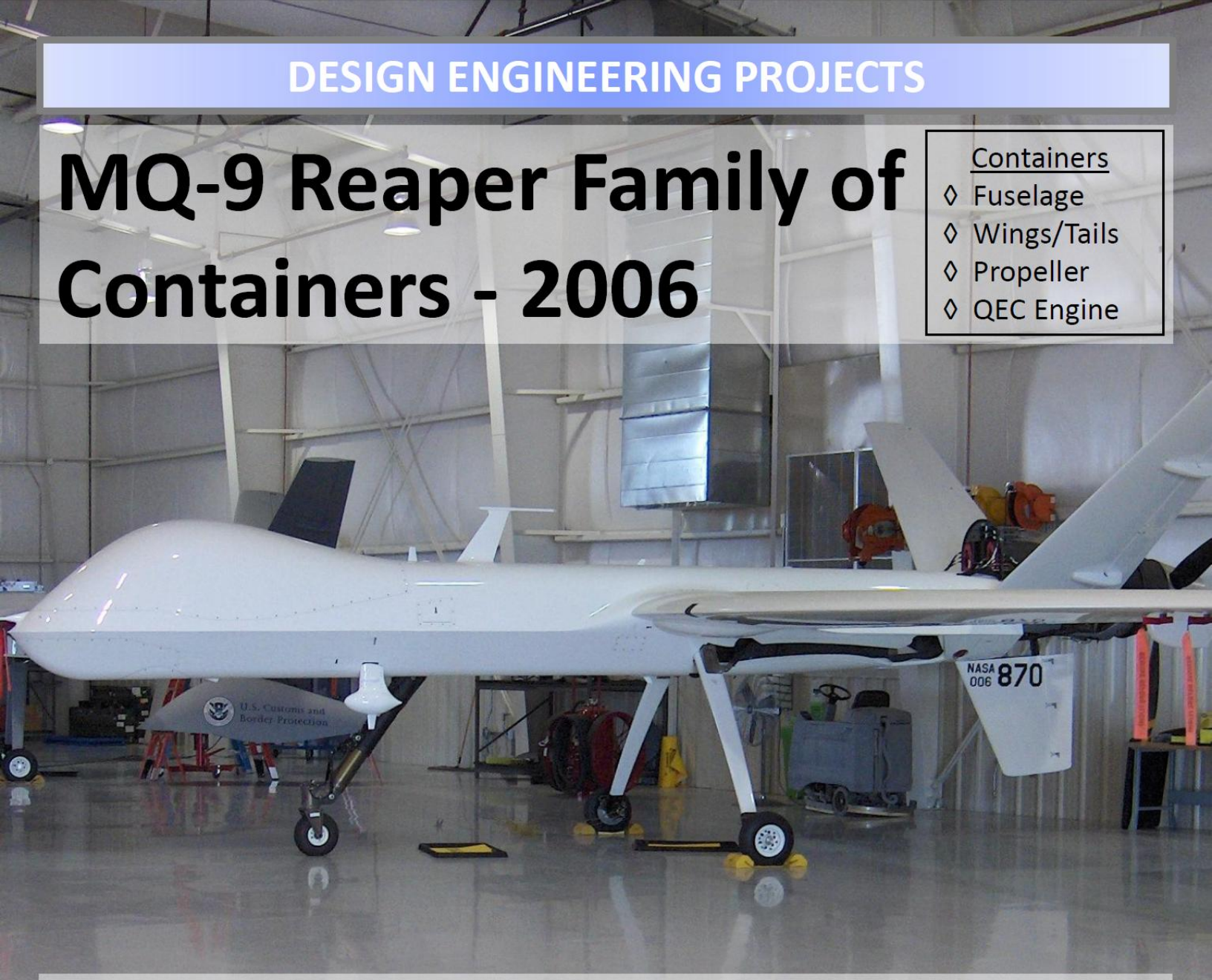
C-17 HUD Secured in Cradle System

C-17 Heads-Up Display Unit Container - 2004

The Heads-Up Display (HUD) unit container is a replacement for a wood/fiberboard combination box which used foam cushioning for shock protection and a barrier bag for environmental protection. The box provides inadequate environmental and shock protection for the HUD. The CNU-676/E container has the ability to control/eliminate humidity inside the container and removes the requirement for a barrier bag which is required in the current package. An aluminum cradle system is integrated into the base suspended on four stainless steel helical isolators that provide shock and vibration protection to 30 G's. The HUD rests in the cradle system and two bars are rotated over the HUD, on opposite ends, and tightened with knobs to secure the HUD to the cradle system. Silicone rubber pads provide friction to keep the HUD from sliding on the aluminum surfaces and provide abrasion protection from metal edges. The cradle allows easy loading and unloading of the HUD as well as easy access for inspection and possible repair while the HUD is still in the container.

MQ-9 Reaper Family of Containers - 2006

Containers
- ◊ Fuselage
- ◊ Wings/Tails
- ◊ Propeller
- ◊ QEC Engine

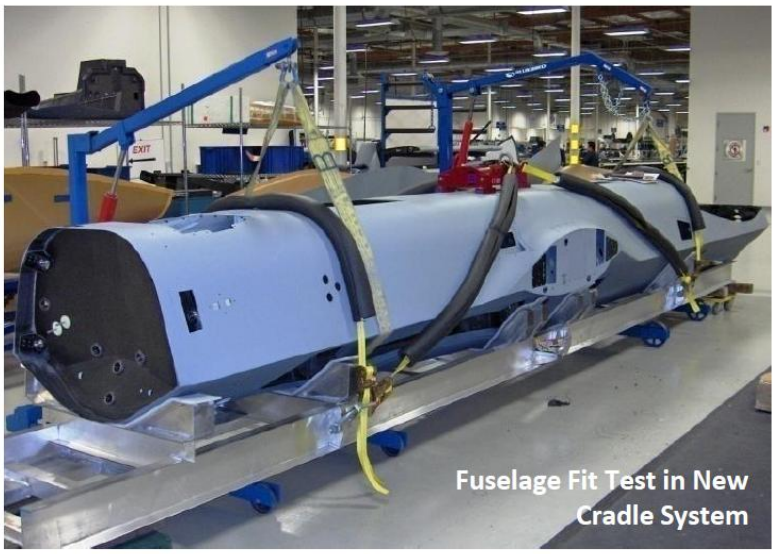


The MQ-9 logistics program office at Wright-Patterson came to us looking for a resolution to their rapid deployment problems concerning transportation and handling of their aircraft and spares. Current containers could not meet the requirements for C-130 transport or handling using a 10K forklift. The container being used at the time was a larger version of the fiberglass container used by the MQ-1 aircraft. The excessive weight, insufficient structural strength, and handling and transport problems of the container made it impossible to meet rapid deployment requirements. In addition, the fiberglass design is susceptible to deformation under constant load, cracking under extreme temperatures, and delamination if exposed to UV rays for a prolonged period of time. These factors could lead to asset damage or, at minimum, corrosion problems. AFPTEF was able to design a set of two aluminum, long-life containers that house the fuselage and wings/tails separately. They are designed with retractable casters for aircraft loading, can easily be lifted with a 10K forklift, and fit on a C-130 aircraft. In addition, they are sealed from the environment and provide shock and vibration protection. The new container designs now interface properly with the required support equipment. We also designed containers for the propeller and spare engines with their QEC kits installed. The containers provide environmental protection, shock and vibration protection, interface with support equipment, and meet handling and transport requirements. **In 2006, the cost avoidance over the 20 year life cycle of the containers was expected to be 15 million.**

MQ-9 Reaper Fuselage Container - 2006

The MQ-9 Reaper fuselage, wings, and tails were shipped and stored in a single fiberglass container that required a forklift with greater than 10k rated capacity. This was the main problem due to limited availability of ground support equipment (GSE) at some operating locations. The Air Force requirement was that the MQ-9 Reaper containers could be handled by a forklift with a common 10k rated lift capacity. This prompted the MQ-9 Reaper program office and AFPTEF to develop a new family of containers which house the MQ-9 Reaper Fuselage and its components separate from the wings and tails. The new MQ-9 Reaper fuselage shipping and storage container is a sealed, welded aluminum, controlled breathing, reusable container that is engineered for the physical and environmental protection of the fuselage during worldwide transportation and storage.

Fuselage Container Cover being Lifted



Fuselage Fit Test in New Cradle System

The cover is removable with built in and fully enclosed forklift pockets. During cover removal, four corner guide posts keep the cover away from the fuselage. These fold down to facilitate fuselage loading/unloading. The cradle is designed to support the fuselage at bulkhead locations. The cradle is suspended in the base by 12 stainless steel wire rope coil isolators that protect the fuselage, keeping the response from shock and vibration below the 20G fragility requirement. A foam lined saddle that is perfectly contoured to fit the underside of the fuselage cross section at each of the eight interface locations (between the cradle and the fuselage) provides support. Six ratchet cargo straps fasten the fuselage to the cradle. There is also an additional strap mount system that pins into the aircraft tie down lugs for additional vertical restraint. Inside the center of the base on the right and left sides, an area for ballast storage has been provided where up to 150 lbs of ballast plates can be stowed. There are fully enclosed shadow boxes inside the base at the extreme fwd locations to contain assorted small parts. For rapid C-130 deployment capability, a retractable caster system was developed so that the container could roll onto a C-130 then, subsequently, since the container is narrow enough for a walkway along the side, the casters could be retracted to either set the container on blocks or lower the container directly onto the floor of the aircraft. This system was designed to operate under the full load of the container weight without any external lifting device.

MQ-9 Reaper Wing Container - 2006

The MQ-9 Reaper wings shipping and storage container has an exterior that is nearly identical to that of the fuselage. During cover removal, four corner guide posts keep the cover away from the wings and tails. These fold down to facilitate wing and tail loading/unloading. The wings are positioned with the bottom of each wing facing the outside of the container to allow use of wing jacks, which is now

A capability due to the new container. That allows each wing to be removed from the container and installed on the aircraft with the same piece of ground support equipment. The cradle is designed to support each of the two wings at three locations along the wing surface and one location on a wing spar, each of the two diagonal tails at two locations along the tail surface and one location on a tail spar, and the vertical tail in a foam lined aluminum box. The cradle is suspended in the base by eight stainless steel wire rope coil isolators that protect the wings and tails, keeping the response from shock and vibration below the 20G fragility requirement. Each wing surface support location fully encloses the wing with foam lined and partially removable structures that are secured by cam buckle straps. There are three basic components at each of the wing surface support locations: a lower section that the wing is lowered into with the wing jacks, an adjustable inner A-frame support, and a removable L-frame support that is held in place with a cam buckle strap. The wing spar support has a post that interfaces with the spar pin holes; the spar is also tied down with a cam buckle strap. The diagonal tails and the vertical tail are positioned in the center of the cradle between the two wings.

Wings and Tails Secured in the Cradle Isolation System

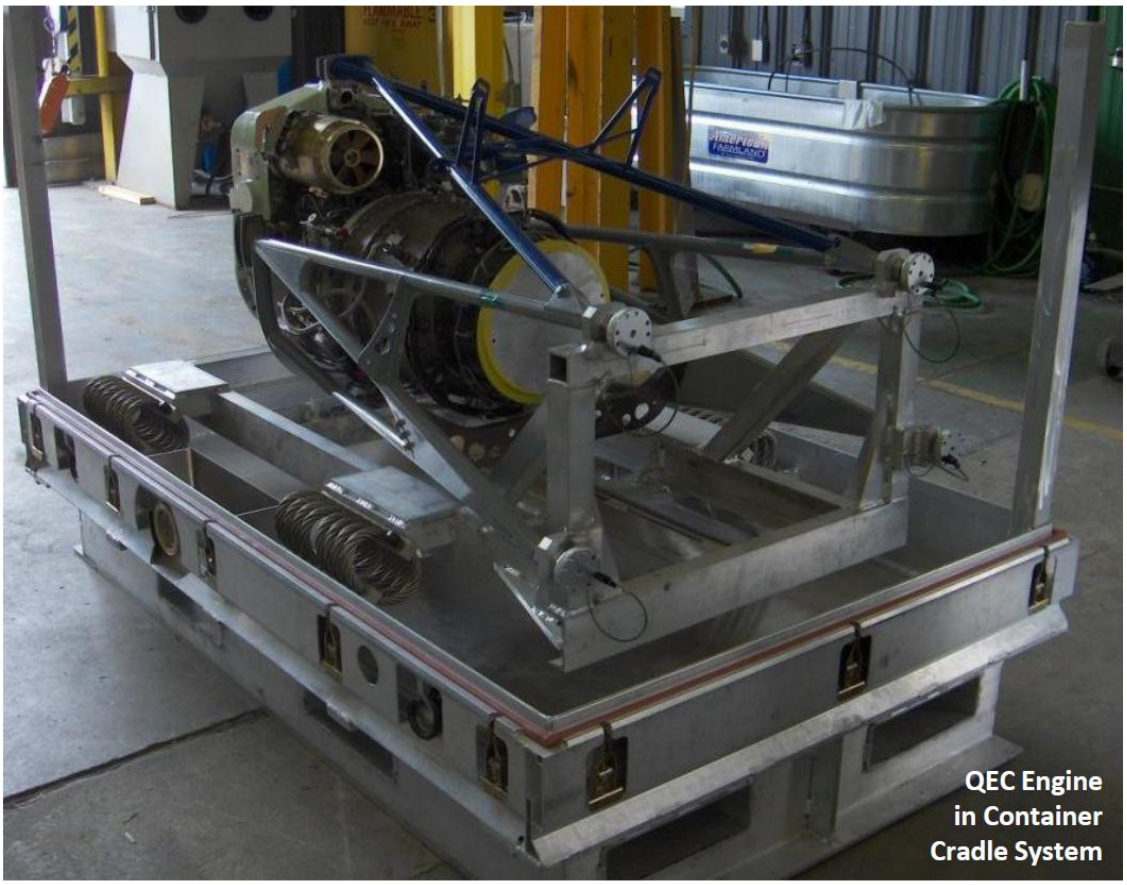
Similar to the spar supports used for the wings, tail spar holes interface with a post and are held in place by cam buckle straps. Two of the three A-frame wing supports have a secondary purpose to capture the diagonal tails which pass through the center of them. These two A-frames open in the center and are removable in order to access and remove the diagonal tails. The foam lined aluminum box that encloses the vertical tail closes securely with a cam over center latch. For rapid C-130 deployment capability, a retractable caster system was developed so that the container could roll onto a C-130 then, subsequently, since the container is narrow enough for a walkway along the side, the casters could be retracted to either set the container on blocks or lower the container directly onto the floor of the aircraft. This system was designed to operate under the full load of the container weight without any external lifting device.

Propeller Fit Check in New Consolidated Container

MQ-9 Reaper Propeller Container - 2006

The Reaper Propeller was being shipped in a fiberglass container. The container can not house the propeller and spinner when disassembled. A foam isolation system is integrated into the base of the new container and provides shock and vibration protection to 20 G's. The propeller hub rests on a high density polyethylene load spreader that is integrated into the center foam assembly. The hole pattern in the load spreader follows the pin pattern on the propeller hub. The blades rest on six foam assemblies with silicone rubber load spreaders and are held in place by six heavy duty Velcro straps. The spinner and its parts are secured in the two parts boxes.

DESIGN ENGINEERING PROJECTS



QEC Engine in Container Cradle System

MQ-9 Reaper QEC Engine Container - 2007

Reaper program office personnel at Wright-Patterson AFB contacted AFPTEF to request the design of a reusable container for the MQ-9 Reaper Engine that would eliminate current shipping and storage risks. The Reaper Engine is currently shipped in a fiberboard box. The box does not have environmental controls and is not sealed by the nature of its construction. There is no means to control breathing or remove the excess moisture that results, which could cause a corrosion problem for the Engine. The box also lacks any shock protection and cannot house the engine in its QEC configuration. The current packaging degrades readily and cannot be stored outside. AFPTEF's new container design resolves all of these issues. An aluminum cradle system is integrated into the base and suspended on four stainless steel helical wire rope isolators mounted at 45 degree angles that provide shock and vibration protection to 10 G's. Prior to installation of the Engine the Beta Tube must be secured in the polyethylene foam lined aluminum box in the center of the cradle. The QEC Engine is then attached to the cradle system by inserting the four threaded pins of the engine truss and securing them with four aluminum knobs. The knobs are locked in place with quick pins. A clamp is then rotated up and tightened on the aft end of the engine truss.

The Air Force Global Logistics Support Center (AFGLSC) stood up in FY08 and is the supply chain manager for the Air Force. The AFGLSC has a concept of operations, which integrates Supply Chain (SC) processes into a single end-to-end enterprise process. The three functions within the AFGLSC are Supply Chain Planning & Execution (SCP&E), Supply Chain Operations (SCO) and Supply Chain Strategy & Integration (SCS&I). Combined with other key logistics initiatives, AFGLSC is helping the Air Force meet its eLog21 goals of reducing annual operating support costs by 10 percent and increasing equipment availability by 20 percent.

The cost avoidance for the Air Force due to the specialized long-life containers outlined throughout this report will be millions. Calculated cost avoidance includes dollars saved over the expected 20 year life cycle of the container by:

- Eliminating the need for repeat builds of wood and fiberboard containers with a one-time purchase of a long life aluminum containers
- Decreasing manpower by reducing effort related to loading/unloading, packing, and handling
- Reducing asset repair and loss by improving shock and environmental protection during shipping and handling

F-22 Raptor Canopy Container - 2007

The Air Force Packaging Technology and Engineering Facility (AFPTEF) was asked to develop a specialized long-life, aluminum, container for the F-22 Canopy. We worked with Lockheed Martin and the Program Office (ASC/YFS) to develop a container that better protects the canopy from shock, vibration, and the environment. The installation and removal process was improved as well with the new design. The new container is engineered for the physical and environmental protection of the canopy during worldwide transportation and storage. The container consists of a low profile base, cradle system and a completely removable cover. The base is a one piece skid/double walled extrusion with four-way enclosed forklift openings (allowing the container to be safely lifted from the ends as well as the sides), humidity indicator, pressure equalizing valve, and desiccant port for easy replacement of desiccant. A silicone rubber gasket and quick release cam-over-center latches create a water/air-tight seal at the base/cover interface. An aluminum cradle system is integrated into the base and suspended on six helical isolators that provide shock and vibration protection to 50 G's. The canopy is attached to the cradle system on the aft end by rotating a rod into the hooks and securing by tightening two knobs. The forward end is attached by tightening two hook clamps over frame pins. There are no detachable parts on the container other than the container lid, which eliminates FOD risks. The cradle system raises the canopy slightly above the container base which improves access to the securing features and allows a much easier installation and removal process. To date, we have fabricated the prototype cradle system and performed a successful fit test with the canopy. The container has passed first article testing and is currently in the latter part of the production phase.

Canopy Container during Resonance Dwell Vibration Test

B-52 Nose Radome Container - 2005

Radome Fit Check in Cradle

Representatives from Tinker Air Force Base (OK) contacted AFPTEF to request an evaluation of current packaging and handling processes for the B-52 Nose Radome. Field units were reporting damaged radomes, some of which were beyond mission use. Tinker AFB representatives realized the current container was not meeting the requirements of the users and requested the design of a reusable container that would meet the requirements. The CNU-680/E container's design meets all the users' requirements with one exception; the rotational feature. This was a feature we tried to incorporate to simulate a sling used by maintenance personnel at Tinker AFB to rotate the radome. The center of gravity moved with the addition of material, thus requiring too much force to rotate the radome and making this operation unsafe. Helical isolators suspend the cradle system and provide shock and vibration protection to 50 G's. The isolated cradle system holds the lifting frame in place using four clamps. The lifting frame in turn attaches to the radome using four guide pins and 4 attachment points.

AFPTEF TEST EQUIPMENT

- ELECTROHYDRAULIC VIBRATION TEST MACHINE
- CONTAINER DROP TESTER
- TEMPERATURE/ HUMIDITY WALK-IN ENVIRONMENTAL CHAMBERS
- PENDULUM IMPACT TESTER
- RAIN/SALT-FOG/WIND WALK-IN ENVIRONMENTAL CHAMBER
- ALTITUDE CHAMBER
- DYNAMIC CUSHION TESTER - LANSMONT MODEL 23
- CONSTANT TEMPERATURE/ HUMIDITY CABINET
- DIGITAL PRESSURE/VACUUM MANOMETER
- TIE DOWN/HANDLE PULL TESTER
- DIGITAL DATA ACQUISITION STORAGE
- UNIVERSAL TENSILE/COMPRESSION TESTING MACHINE
  - PEAK G SHOCK
  - VIBRATION ACCELERATION, RESONANCE AND ANALYSIS

MH-53 Armor Plating Panel Container - 2007

The MH-53 special operations program office at Robins AFB asked if AFPTEF could design a container that would be structurally sound enough to hold the 1900 pound armor plating panel set for the MH-53 Helicopter. The wood crate the systems were being shipped in by the manufacturer would not hold up under the rigorous requirements of the military transportation cycle. The wood crate was also very difficult to lift and maneuver with minimal forklift tine access. AFPTEF was able to design a very rugged, long-life, aluminum container that would easily protect the assets during world wide transportation and storage. Packing instructions for layering the panels and parts were also developed and these reduced the overall size of the container by 25%.

Completed Containers ready to be fielded

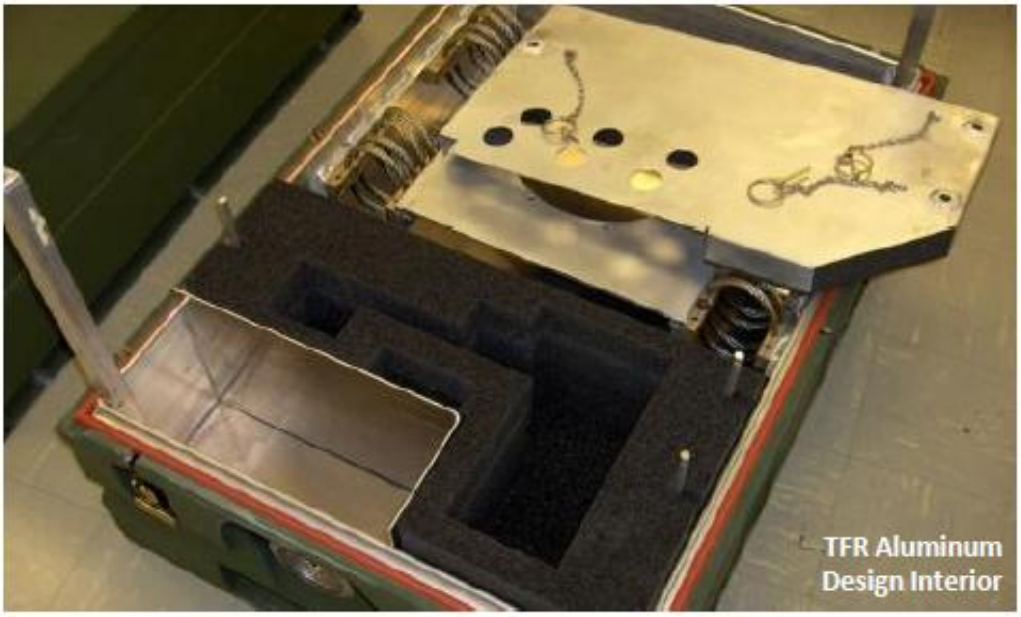
DESIGN ENGINEERING PROJECTS

Combat Talon I Ground Mapping Radar Container - 2002

The Combat Talon I program office at Robins AFB asked our office to design an aluminum long-life container for shipping and storing the Combat Talon I, APQ-122, Ground Mapping Radar Antenna (GMAP). We had previously tested a plastic commercial-off-the-shelf (COTS) container developed for the antenna, but the COTS container failed to pass the qualification testing.

Failed GMR Plastic Design

GMR Aluminum Design


TFR Aluminum Design Interior

Combat Talon I Terrain Following Radar Container - 2005

Based on the success of the FY2002 Combat Talon I, APQ-122, Ground Mapping Radar (GMAP) Antenna Container that AFPTEF designed and manufactured, representatives from Robins AFB decided that they wanted the same level of protection for the TFR Antenna. The TFR Antenna was being shipped and stored in a wood and fiberglass combination container. The container was not sealed by the nature of its construction, which caused a corrosion problem on the antenna. The cradle system seemed adequate based on the lack of reported shipping damage. However, in many cases the foam based cradle system broke down and was totally ineffective for mitigating shock to the antenna. The CNU-682/E container is engineered for the physical and environmental protection of the antenna during worldwide transportation and storage. An aluminum cradle system is mounted on four helical steel isolators, which in turn are mounted to the interior sides of the container. The isolators limit the transmission of shock to the antenna to 20 Gs. The antenna is attached to the cradle system with eight bolts that are captive on the antenna. In addition to the antenna, there is also a section of the container that accommodates the waveguide. This compartment is located on the aft end of the container and is made of a built up polyethylene foam cushioning and detachable lid. The waveguide compartment lid is held in place by three linch pins that pass through three posts that are welded into the container base.

Combat Talon II Nose Radome Container - 2005

The Air Force Packaging Technology and Engineering Facility (AFPTEF) designed a specialized wooden crate for the Combat Talon II Nose Radome in 1990. The program office requested a wood crate vs. a long life aluminum container at the time to reduce up front cost in fielding the

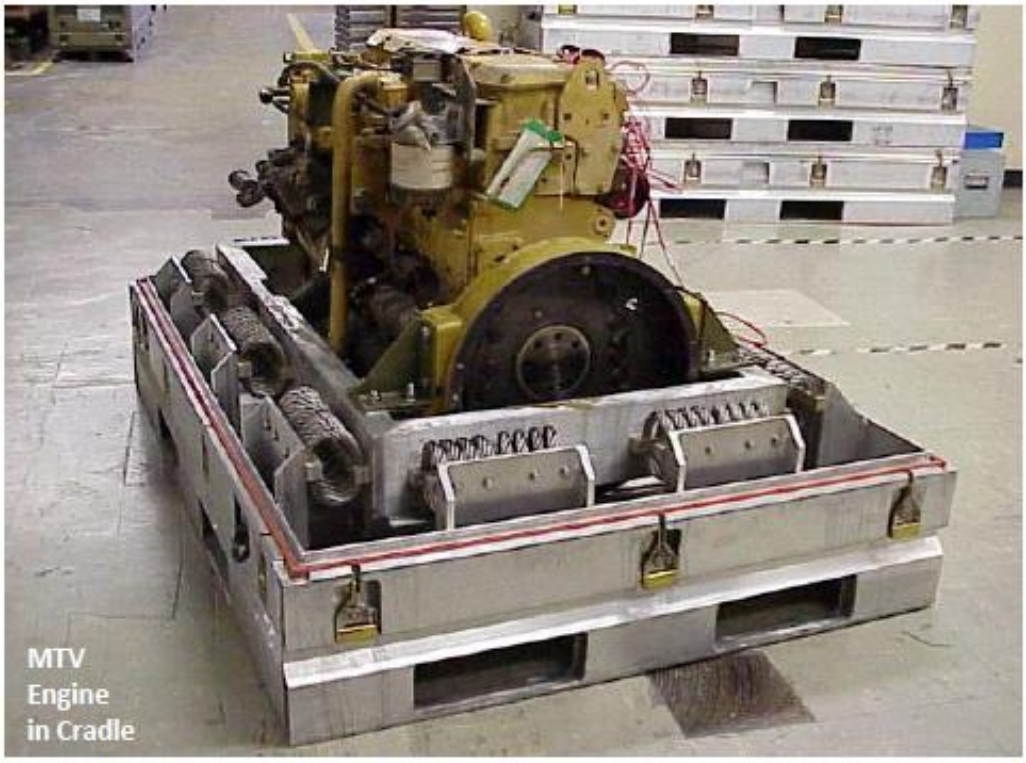

Radome Prototype Fit Test


Radome Production Unit

containers. The wood crate has been used in the field since then. The program office at Robins AFB came to us in May of 2005 and asked us to design a new long-life aluminum container to replace the wood crates. The crates were wearing out and making more wasn't deemed cost effective. So we designed an aluminum, water-tight container, compatible with the aluminum cradle system in the wood crate design. The aluminum cradle/pallet systems were still fully functional. The design met user requirements. Production containers were fully fielded by June 2007.

Family of Medium Tactical Vehicles Engine Container - 2001

The US Army Tank-Automotive and Armaments Command (TACOM) packaging group (AMSTA-TR-E) located in Warren, MI requested that the Air Force Packaging Technology and Engineering Facility (AFPTEF) develop a container to transport and store one spare engine of a Family of Medium Tactical Vehicles (FMTV) truck engines. Justification by the program office for this project was a lighter, more economical container with less maintenance requirements and better protection for the engine. The current steel container has 4 X 4 wood skids, 24 nut and bolt pairs that attached the cover to the base, and rubber shock mounts that have to be replaced frequently. The new container is virtually maintenance free and is very user-friendly. The engine is mounted to an internal cradle system, constructed using aluminum plate and channel, using stainless steel bolts. Six side-mounted (three on each side) and four end-mounted (two on each end) stainless steel coil flex mounts suspend the item/cradle inside the container for shock and vibration protection to 50 G's.


MTV Engine in Cradle




Family of F-15 Toolkit Containers - 2001

Top: Wing Adapter, Wing Sling Kit, Vertical Replacement Toolkit, Vertical Stab Sling

Bottom: -90 Top Level, -90 Middle Level, -90 Bottom Level

The F-15 Depot Maintenance group (LFP) asked the Air Force Packaging Technology and Engineering Facility (AFPTEF) to design and fabricate a small number of containers to transport various F-15 toolkits. The kits were being transported in wood crates. The new water-tight aluminum container designs would allow for the kits to be stored, inventoried, and transported all in the same container. The new designs offer better protection from shock, vibration and environmental conditions to the contents packaged inside. Cut outs in the polyethylene foam conforming to part shapes keep the kits organized and allow the users quick inventory and replacement capabilities. Containers were developed for the Vertical Replacement Toolkit, the FWD & AFT Box Toolkit, the Mating Positioner Toolkit, the Vertical Stab Sling, the Wing Sling Kit, the Wing Adaptor Assembly, and the -90 Toolkit.

-90 Container

The Air Force Packaging Technology and Engineering Facility (AFPTEF), with the help of the packaging specialists at Robins AFB, designed and fabricated a small number of containers to transport their F-15 portable drill-press toolkits. The $70K kits were being stacked in wood boxes for shipping. Parts were being lost and damaged (i.e. many of the specialized reamers and drills valued at $50 each were being broken). Smaller items such as drill bits, reamers, alignment pins, and collets are now placed in the four part boxes. Placement of the small tools allows the depot staff to perform quick inventory and replacements. The part boxes fit into foam cutouts on a removable tray. The tray is removed to gain access to the larger tools. The larger tools are placed in detailed cutouts in the middle cushion for safe storage during shipping. The detailed cutouts allow users to locate and replace tools at a glance. Removal of the middle cushion allows users access to the bottom cushion where larger templates are stored. This storage in layers allowed for design of a smaller, more manageable (20% smaller) container. The order of storage is based on size and frequency of use (i.e. the least used in the bottom). The long-life (20-years) container is made from double wall aluminum extrusions that are lightweight and very rugged. The container has a hinged cover with positive stops for easy access. A silicone rubber gasket creates a watertight environment for protecting the items. The polyethylene foam cushions serve a double purpose of organizing the kit and protecting it from shock and vibration. **The Air Force will realize a cost avoidance (over the 20 year life span) of $1 million.**



REFURBISHMENT PROJECT

F-15 Canopy Container Refurbishments - 2008

In 1990 AFPTEF designed a specialized reusable, long-life aluminum container that holds both the one-man and two-man F-15 Canopies. Environmental conditions, namely humidity, was deforming new and refurbished canopies to the point they could not be installed on the aircraft. The new production containers were fielded in 1995. In August of 2007 the item manager at Robins AFB asked AFPTEF if we could repair some damaged containers that could no longer be used for shipping the canopies. Thirty containers were shipped to AFPTEF for inspection and repair. Over all the containers were in good shape for being in the field for twelve years. Most of the repair consisted of fixing fork lift damage, replacing missing and damaged container hardware, and missing or damaged cradle parts. In addition, AFPTEF cleaned the containers, removing all the old shipping graffiti, re-stenciled, and made sure each container was again sealed from humidity. In addition, we re-enforced the container ends, applied corrosion coatings to the clamps, and stiffened the container sides to increase container resistance to damage for future use. **Refurbishing these containers, instead of procuring new assets, will enable the Air Force to benefit from an immediate cost avoidance of 375K.**

Aft Clamps before and after

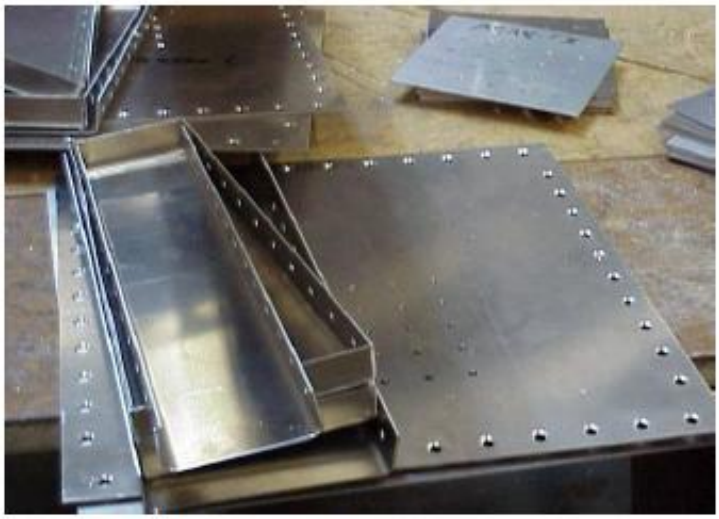
Forward Rests before and after

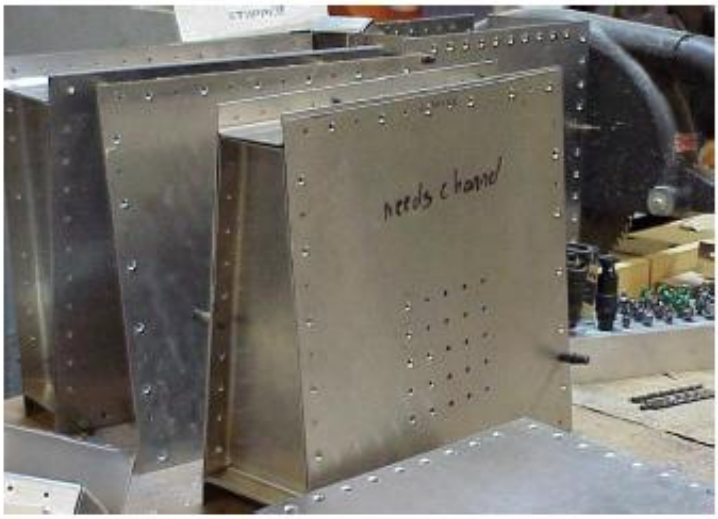
Container Exterior before and after

A sample of documents lead or supported by AFPTEF

SAE ARP 1967 Rev A	CONTAINERS, SHIPPING AND STORAGE
MIL-STD-648D	DESIGN GUIDELINES FOR SPECIALIZED SHIPPING CONTAINERS
MIL-HDBK-304C	PACKAGE CUSHIONING DESIGN
MIL-HDBK-304B	PACKAGE CUSHIONING DESIGN (W/FOAM CURVES)
MIL-V-27166	VALVE, PRESSURE EQUALIZING, GASEOUS PRODUCTS
PPP-B-1672	SHIPPING BOXES WITH CUSHIONING (FAST PACKS)
MIL-C-83669 (INACTIVE)	CONTAINERS, NESTABLE OR COLLAPSIBLE, REUSABLE SHIPPING AND STORAGE
ASTM D 6255	SLOTTED ANGLE CRATES (MIL-C-9897)
ASTM D 6254	WIREBOUND PALLET-TYPE WOOD BOXES (PPP-B-587B)
MIL-PRF-26514	POLYURETHANE, RIGID OR FLEXIBLE FOAM-IN-PLACE PACKAGING MATERIALS
MIL-PRF-83671	PACKAGING MATERIAL, SHEET (PPP-C-1752)
A-A-59135	CUSHIONING MATERIAL, PACKAGING, CLOSED CELL FOAM PLANK (PPP-C-1752)
A-A-59136	

MATERIALS ENGINEERING AND TESTING





Simulated Aircraft Structures (SAS) - 2003

Left: SAS Parts
Right: SAS Fixtures

The environmental engineering group at Wright-Patterson asked AFPTEF to fabricate some Simulated Aircraft Structures (SAS) for corrosion resistant coating testing. The structures represented sections of aircraft wing fuel tanks. The main purpose of the testing was to find the best coating or combination of coatings to prevent corrosion on the structure and fasteners. The parts were fabricated from different series of aluminum and supported different fastener sets for testing.

Marine Prepositioning ISO Pallet Testing -2007

Left: Flat Drop on Vehicle Control Pallet (VCP)
Right: Pendulum Impact on Consolidation Control Pallet (CCP)

The Marines at Blount Island Command asked AFPTEF to develop a performance specification to ensure all military logistical requirements would be met while procuring numerous ISO pallets/containers to be used in their prepositioning ships. AFPTEF had to ensure transportation, handling, storage, structural integrity, and corrosion protection requirements were covered. AFPTEF engineers wrote the specification, assisted BIC in source selection, and performed First Article testing and evaluation.

HISTORY

Wright-Patterson
Air Force Base

In September 1944, a packaging engineering function was organized under the Army Air Corps as the Packaging Branch, Engineering Standards Division, at Wright Field (now Wright-Patterson AFB) in Ohio.

On 21 Apr 1952, Air Material Command (AMC) Organizational Directive 20-670 reestablished it as the "Packaging Division" of the Air Force Systems Command (AFSC) Materials Laboratory.

In 1955 the Packaging Engineering Section was established at Brookley AFB. On 6 Oct 1959 , the packaging engineering function was formally assigned to Air Research and Development Center (ARDC) Brookley AFB, Mobile Air Materiel Area (MOAMA) near Mobile, Alabama per AFR 71-1.

-While at Brookley the organization was variously called the Packaging Research and Engineering Branch and Air Force Packaging Laboratory.

-In January 1964 AFPEA was established as a Named Activity "Air Force Packaging Evaluation Agency" per Special Order G-29.

-With the impending closure of Brookley AFB, the packaging organization returned to Wright-Patterson AFB, and was assigned to HQ Air Force Logistics Command (AFLC) on 6 July 1967. The transfer actually took from 1966 to 1970 to complete and regain operational status. Total losses due to the relocation have been estimated to exceed $20 million - mostly due to programs that were adversely impacted by lack of AFPEA support during the move.

During the 1980s, AFPEA was reassigned several times. Notable changes were assignment to HQ Air Force Logistics Command (AFLC) by Special Order GA-24, signed by William R. Carroll, Colonel, USAF , Reassignment to the Air Force Distribution Agency (AFDA) on 16 Feb 1987, and re-designation from Agency to Activity by Special Order GA-11, dated 19 Feb 1987.

The mid-1980s saw a major shift in AFPEA workload from trying to field-fix existing problems to preventing them.

On 1 Jul 1991 the Packaging Policy office was reassigned as a branch of AFPEA and physically moved into Building 70. Even though the Policy group had been co-located with AFPEA in Building 70 during the 1967-1975 timeframe, it was separately managed. This reassignment marks the first merger of these two packaging functions within the Air Force. Concurrently the Air Force restructuring changed the office symbol from HQ AFLC/DSTZ to HQ AFLC/LGTP.

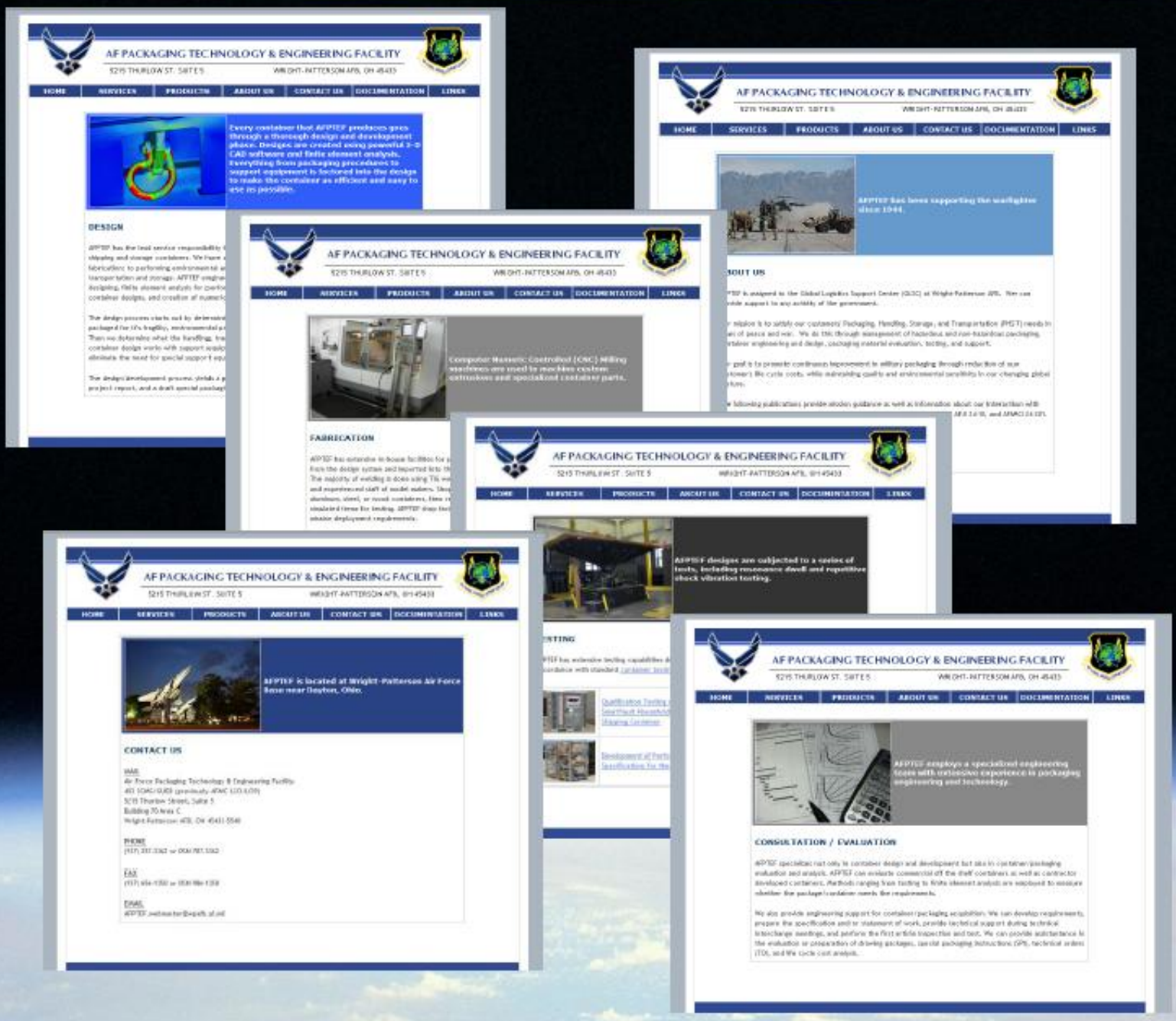
On 1 Jul 1992, Air Force Materiel Command (AFMC) was formed by consolidating the missions, talents, and expertise of both AFLC and Air Force Systems Command (AFSC).

AFPEA officially ended on 1 Oct 94, when the Air Force formed the AFMC Logistics Support Office (LSO) and we were renamed AFPTEF.

During the 1990s we greatly expanded our design capability with parametric computer design systems and rapid prototyping. The prototyping was greatly assisted by the addition of numerical-control machining equipment with computer linking. Container testing was upgraded with the purchase of nearly $1M of new chambers, vibration tables and ancillary test equipment. This put AFPTEF in the position of being one of the best equipped organizations of its type in the government.

In 1998, a decision was made that resulted in AFPTEF being downsized and converted to a fee-for-service organization. Packaging Policy is no longer a part of AFPTEF.

PACKWEB REDESIGN



PackWeb, AFPTEF's longstanding webpage, underwent a face lift in 2008. The site, which was originally launched in the 90's, was in desperate need of a makeover. The new sight includes a great deal of additional information, a smart new look, and a better user interface to make information easier to find.

More Information

The new PackWEB is loaded with information. To begin with, there is detailed information and separate links for AFPTEF's four major services; Design, Fabrication, Testing and Consultation. The products page, however, is where the biggest difference can be found. This page provides a sample of the containers that AFPTEF has designed over the last 15-20 years. There is also a link to a master list of all containers designed by AFPTEF in that timeframe. The container links lead to individual pages with detailed descriptions and photos for each container. These pages also contain links to respective container project reports.

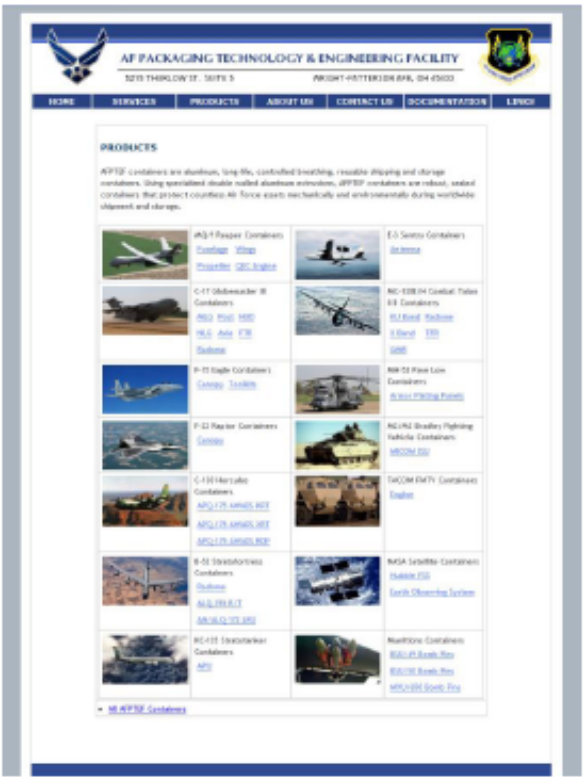
PACKWEB REDESIGN

Beyond the products page there are four documentation pages: Project Reports, Annual Reports, Drawings and Specifications. The project reports page lists all the recent project reports completed by AFPTEF. Each report contains a wealth of design data, test results and analysis. The annual reports page includes AFPTEF yearly reports dating back into the 1980's. The drawing page will provide links to container drawing packages for customers and prospective customers. And finally the specification page lists all the specifications that AFPTEF provides support for.

Improved User Interface

The new PackWEB has a new and improved user interface that makes the site much easier to navigate. As stated earlier, all AFPTEF services, products, and documentation are very accessible through the main dropdown menu. These improvements should make the site easier to use and help to make AFPTEF's capabilities better known throughout the Air Force.

The products page is a user-friendly list of containers that AFPTEF has designed over the last 15 years. This page illustrates the variety of aircraft components and equipment that AFPTEF has worked with.



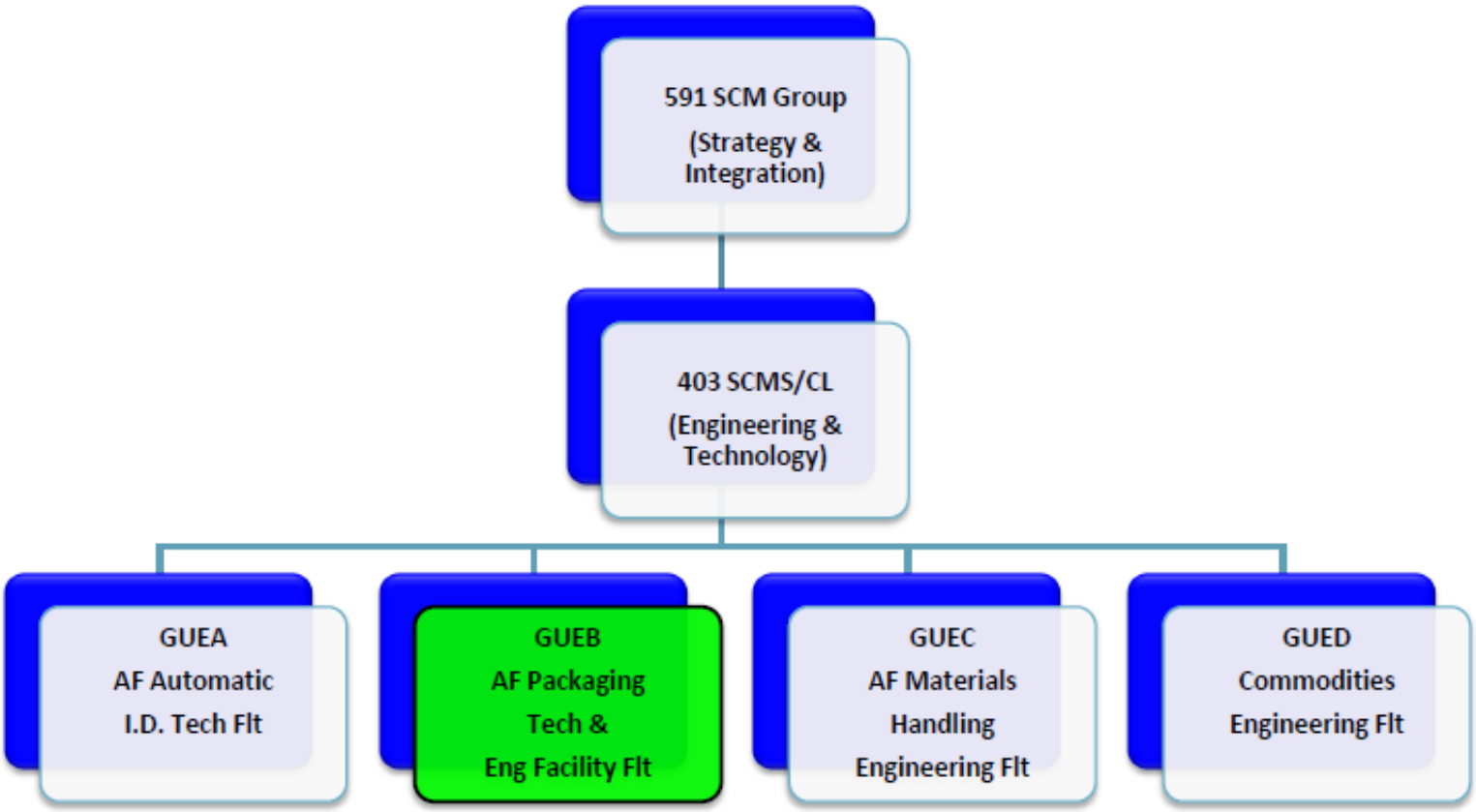
How can you get AFPTEF to solve your packaging or container issue?

Just Contact Us:

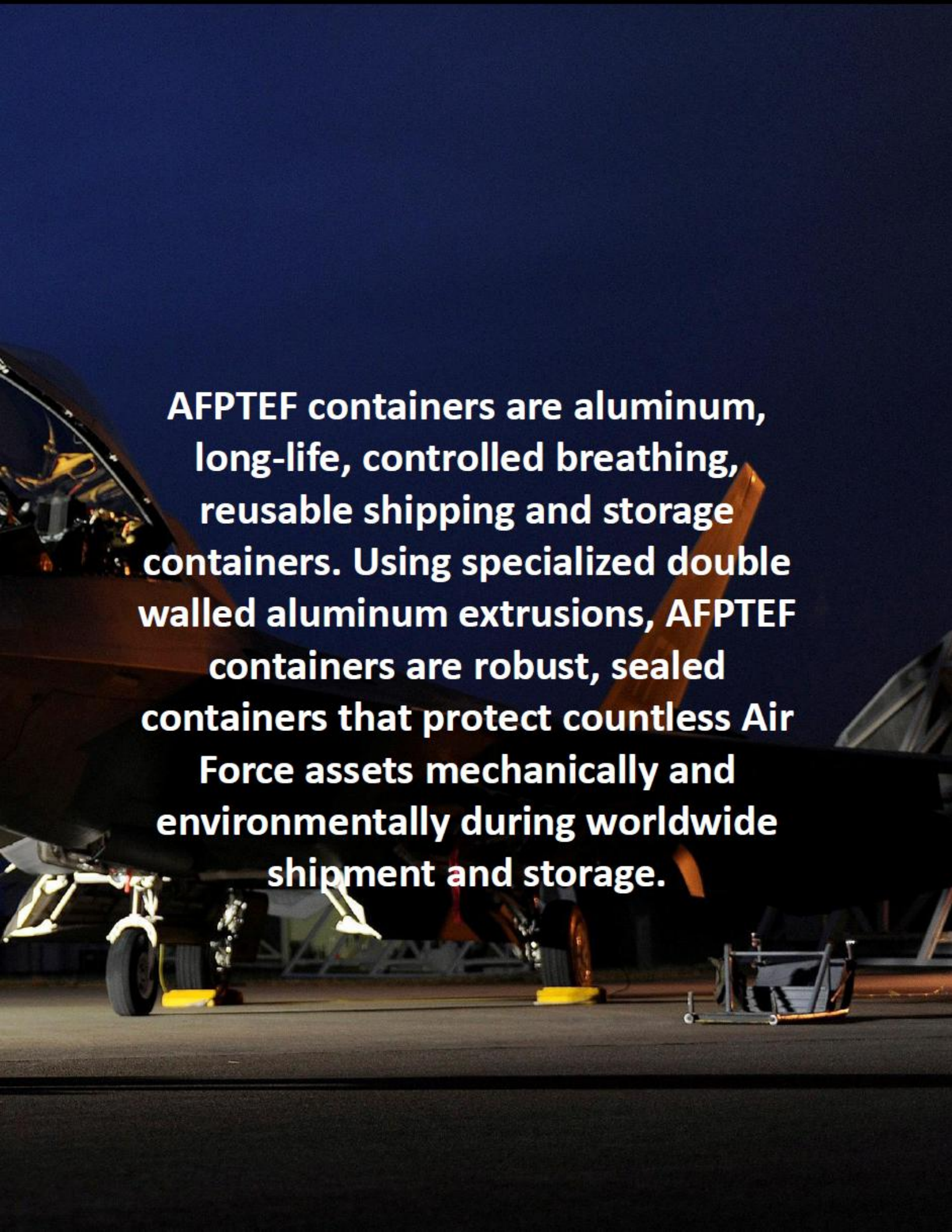
- **By Phone: 937-257-3362**
- **By E-mail: AFPTEF.webmaster@wpafb.af.mil**
- **Visit our Webpage: http://packweb.wpafb.af.mil**

1. **We will evaluate your problem:**
   - Do you have an asset being damaged during storage, handling or transport?
     - Current container doesn't provide sufficient protection from the environment, rough handling, shock, vibration or just difficult to load and unload
   - Do you have a container that has been damaged during storage, handling or transport?
     - Container cannot be stored outside due to susceptibility to environmental damage. Has been damaged from rough handling by forklift or transport. Has missing or damaged hardware. Was not designed to meet mission requirements ,support equipment, or is difficult to handle.
   - Do you have a container contractual issue?
     - Need assistance with source selections, review of contractor proposals, specifications or drawings for containers, or technical advice on container development requirements?
2. **We will determine the requirements:**
   - To meet your mission, operational, logistical and storage needs.
3. **Prepare a proposal and MOA**
   - The proposal will consist of a list of the tasks to be performed, a schedule, the cost and the deliverables
4. **Develop a solution:**
   - Through the design of a new container; by modifying or refurbishing existing containers; by conducting performance testing on existing containers, commercial containers, or packaging materials; or by providing packaging engineering consultation.

403 SCMS/CL ORGANIZATIONAL DIRECTORY



Engineering and Technical Squadron Mission- Provides total life-cycle management to the AF Mechanized Materials Handling Program including responsibilities for the planning, programming, allocation and management of program funds, engineering design, acquisition, installation and testing. Assures technical and engineering progress in container designs and packaging concepts. Provides customer support to AF and other federal agencies, which includes the identification of requirements, contract support, program reviews, container design, fabrication testing and container procurement packages. Responsible for the planning, programming, and allocation of funds for the acquisition and implementation of AIT within the AF. This includes RFID, IUID, and SNT. Provide AF custodian responsibilities for electronic components, fiber optics, wire and cable.



AFPTEF containers are aluminum, long-life, controlled breathing, reusable shipping and storage containers. Using specialized double walled aluminum extrusions, AFPTEF containers are robust, sealed containers that protect countless Air Force assets mechanically and environmentally during worldwide shipment and storage.

Air Force Packaging Technology

& Engineering Facility

5215 Thurlow Street

Suite 5, BLDG 70, Area C

WPAFB, OH 45433-5540

Phone: 937-257-3362

Email: AFPTEF.webmaster@wpafb.af.mil

http://packweb.wpafb.af.mil/